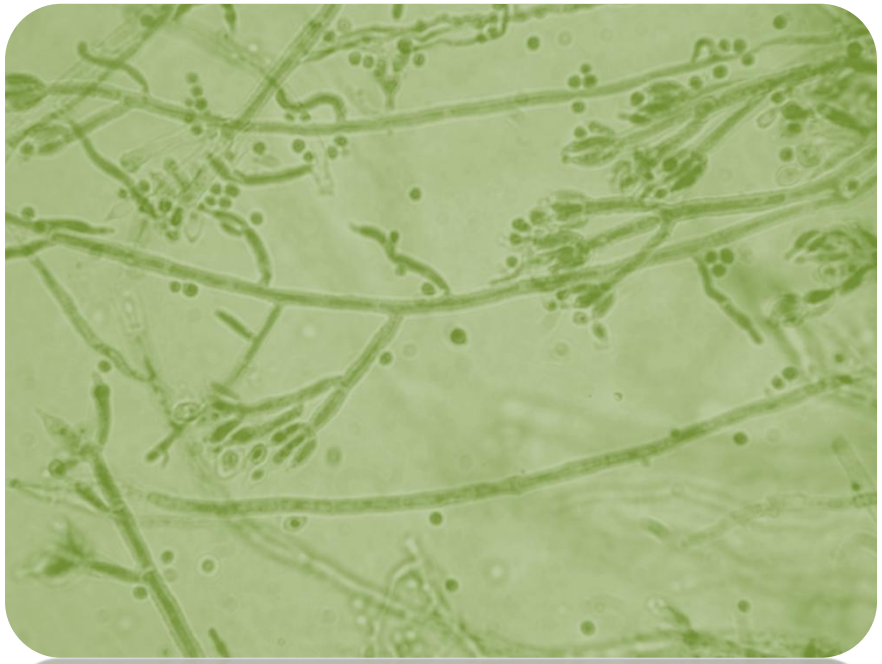
“Preventive and remediation strategies for continuous elimination of poly-chlorinated phenols from forest soils and ground waters”



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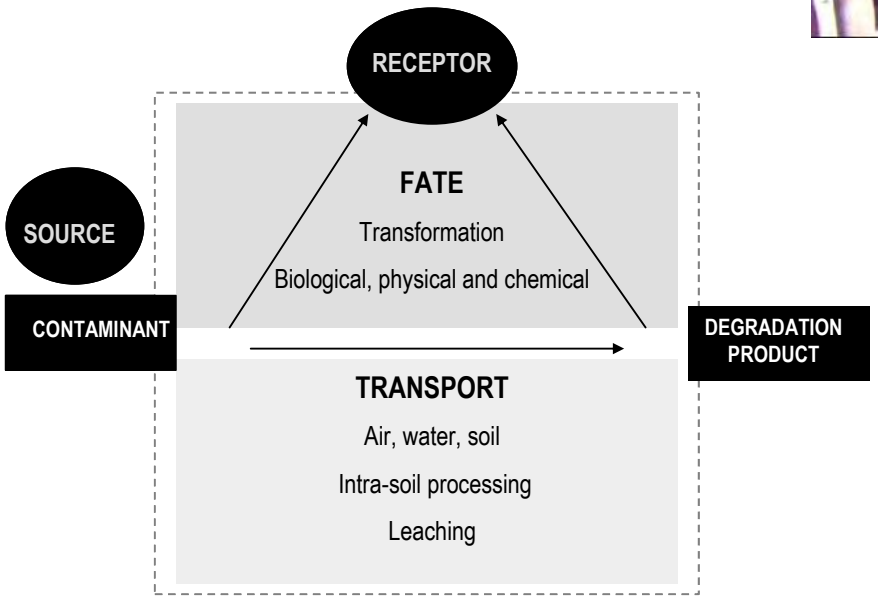
Applied and Environmental Mycology

Instituto de Tecnologia Química e Biológica
Instituto de Biologia Experimental e Tecnológica

NATO-sfp meeting, 2nd- 4th December, 2010

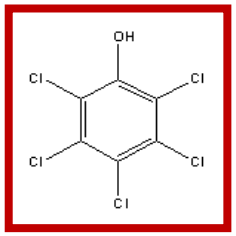
Background justification

Recognise the **interdependence between environmental quality and health**, answering the scientific gaps concerning **chemicals fate in the environment**



The Mediterranean region presents a critical environmental challenge focus on the problem of water scarcity, water pollution, environmental degradation and lack of pollution impact monitoring (EU-WFD).

Persistent organic pollutant natural attenuation/dispersion



PCP as model POP

PCP levels in the environment are still high

Produced during the incineration of urban wastes and chlorination treatments of water
Lack of legislation in some countries
Non-authorised uses

- Introduced as wood preservative in 1936
- Restricted as pesticide in the USA (EPA, 1984) and in Europe (1999)
- Proposed as a probable POP in 2000 and added to the list of priority substances
- Classified as a POP substance in 2001 (EC)
- Classified as Highly Hazardous in 2004 (WHO)
- Toxic to organisms in all ecosystems, human carcinogenic and probable, endocrine disruptor
- **High photo stability**
- **Moderate water solubility and mobility**
- **High absorption to the organic matter in soils**

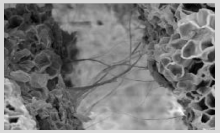
- POPs are widespread in all ecosystems
- Major environmental concern
- **Trans-boundary significance**

POPs

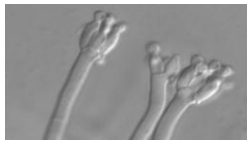
- **Soil behaves as POP main receptor, decay, dispersion vector**
- Soil ascomycetes are extremely well adapted to the soil compartment (high moisture and low oxygen content)
- Active biodegradation agents

Fungi significance in PCP decay

Cork colonising fungi community

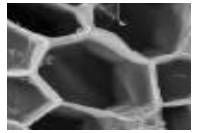


Cork Facts



C. sitophila is the dominant species

Extremely recalcitrant composite



Taxa diversity is dominated by ascomyectes fungi, especially *Penicillium* species

Enriched in suberin (40%) and lignin (20%)

Species diversity is well correlated with the species existing in the surrouding enviroment

2,4,6-TCA- *cork taint off-flavour* - is a common fungi by-product of TCP (or PCP) degradation

Fungi isolates are common soil colonisers

PCP, TCP and related compounds were isolated from cork in forests

Silva Pereira *et al.*, J. Ind Mic & Biot (2000), 24, 256-261;
Oliveira *et al*, Microbiol Res (2003), 158, 117-124;
Basílio *et al.*, Rev Iberoam Micol (2006), 23:151-154
Silva Pereira et al., Int Biodet Biod, 2006,57,244-250

Science for Peace

The Mediterranean region presents a critical environmental challenge focus on the problem of water scarcity, water pollution, environmental degradation and lack of pollution impact monitoring (EU-WFD).

- Water and soil are the key for environment and economic-social welfare

Recognise the opportunity to develop knowledge in a scenario of critical need, favouring the use of science on the road to sustain economies, global environment sustainability and peace

- Oak forests occupies, at a global level, ca. 2,3 millions h

key ecological and socio-economic roles and a sustainable balance between human activities and natural resources

	Forest area hectares	Production Tons/year	World production %
Tunisia	60,000	9,000	3%
Morocco	198,000	15,000	4% (e.g. 19,9 millions US$ 2001)

Project vision

Sources identification

Status characterisation (pollutants heterogeneity and microbial diversity)

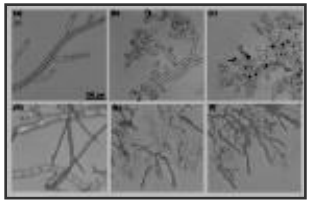
PCP impacts and preliminary risk evaluation

Preventive/curative measures (exploitation of on-site bioremediation potential)

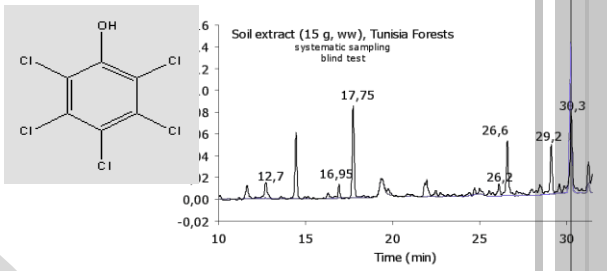
Anthony Gormley

- **Multidisciplinary approach, covering very distinct aspects of pollution assessment**
- **Pollution assessment focussing the high risk of chronic exposure to sub-lethal levels of the pollutant (diluted pollution)**
- **Trans-boundary nature of pollution requires the establishment of common policies**

Microbial diversity



Pollutants heterogeneity



Species and chemical library

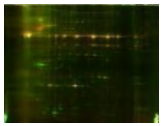
SP4- Chemical analysis

SP5- Microbial analysis

SP1- case study evaluation
SP2- Sampling desing
SP3- Design and optimisation

PCP decay and risk

Functional studies



Microbial bioremediation:

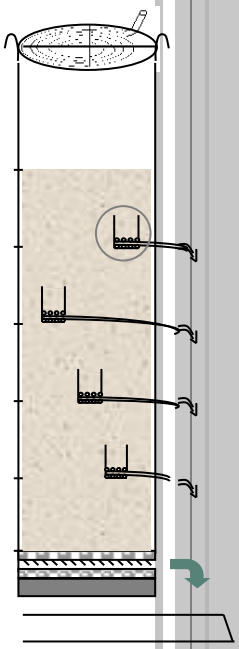
metabolic pathways

SP7- Bioremediation

PCP decay in soil (community effect)

SP8- Bioaccumulation

Bulk soil simulation



Criteria of success

Criteria for Success	Relative weight	Relative weight May 2010
In terms of success of the adoption of new technologies by the industrial partner		
1. Source apportionment and loading of PCP in forest case studies	**5**	**3.5**
2. Monitoring methods, indicators and fate simulation for PCP contaminants	**25**	**21**
3. Microbial contribution to environmental fate and remediation potential	**15**	**12**
4. Production of guideline recommendations for PCP impact and management in forest ecosystems at regulatory/decision making level	**20**	**8**
Legislative and regulatory impacts 3 years after completion		
5. On-site applicability of bioremediation technologies	**10**	**0**
6. Demonstration and wider application of PCP remediation	**25**	**0**
TOTAL	**100**	**44.5**

The team

NATO OTAN Science Programme — Science for Peace
Bringing Scientists together for progress and peace

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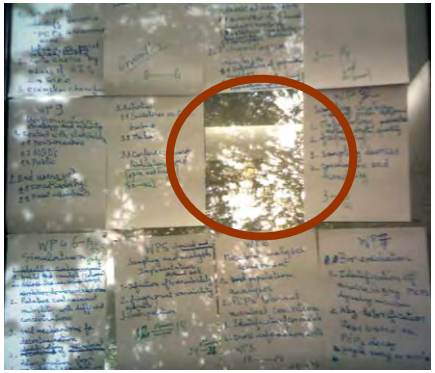
CERTE



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Country	Key expertises
Portugal	Cork mycology: taxonomy, biochemistry, bioremediation Analytic chemistry
UK	Environmental geochemistry; Bioaccumulation; Pollution risk assessment; Forensic toxicology
Italy	Cork science and mycology; Fingerprint of volatile and phenolic compounds
Tunisia	Soil science; Soil hydrodynamic
Morocco	Environmental biotechnology (bacteria); Microbiology; Water treatment

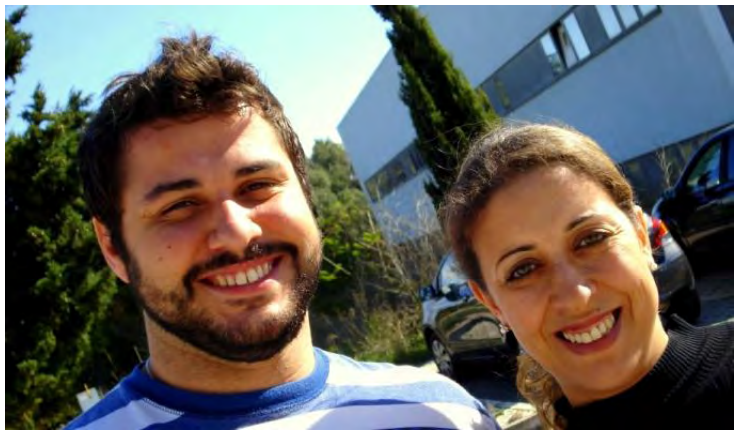
Tabarka meeting - March 2007

Sardinia meeting - March 2008

Casablanca Meeting – December 2008

Oeiras, Portugal Karim training period – June 2009

Amel and Elisa- Training period Oeiras, Portugal– June 2009



Oeiras, Portugal Meeting – June 2010

Oeiras, Portugal Meeting – June 2010

Management…

GPS skills…

Oeiras, Portugal Meeting – June 2010

Communication skills…

Oeiras, Portugal Meeting – June 2010

Work in progress – don't disturb...

Applied and Environmental Mycology Team

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NATO OTAN
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